

REMARKS

Applicant thanks the examiner for the clarification of the rejection and guidance regarding the claims provided in the March 15, 2005 final office action. The claims have been amended accordingly.

Claims 1-5, 15, 18-23, 27, 76, 82-87, 89, and 91 have been amended, claims 47-54, 62-65, 68-70, 73-74, 81, and 90 have been cancelled, and claims 92-94 have been added leaving claims 1-46, 55-61, 71-72, 75-80, 82-89, and 91-94 pending in the application.

The number of independent claims has been reduced by 7. Independent claims 2, 3, 5, 89, 90 have been changed to depend from claim 1, independent claims 20 and 21 have been changed to depend from claim 19, independent claims 81 and 91 have been cancelled, dependent claim 18 has been recast as an independent claim, and independent claim 92 has been added, leaving independent claims 1, 4, 18, 19, 22, 23, 76, 85, 86, and 92 pending in the application.

Applicant's remarks below are preceded by quotations of the related comments of the Examiner in small, boldface type.

2. Claims 1, ... 19, 23, ... 76, 85 ... are rejected under 35 U.S.C. 102(b) as being anticipated by Steigerwald et al (US 5,274,539).

Steigerwald et al discloses a power distributing apparatus comprising a first regulator (30), a bus, and voltage transformation modules (20, see any of figures 4 or 6-9) including switch (Qa and Qb), transformers (T1 and T2), and rectifiers (SRa and SRb).

9. Claims 22 ... are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claim 22 and 75 except for ... a series of operating cycles ... power transfer and energy recycling intervals, ...a period less than 2 microseconds...a power density greater than 250 Watts/ci...

10. Claims ... 86 ... are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 33, 77, 81, and 86-88 except for specifying that the duty cycles ... is greater than 80% or 90%.

Applicant respectfully disagrees. The regulation and voltage transformation functions in the Factorized Power Architecture are separated. This "separation" is contrary to the accepted practice of the industry to combine voltage regulation and transformation. (See the February 2005 response for a more detailed comparison with prior art architectures.) The claimed "separation" has been clarified using structural terms in amended independent claims 1, 19, 22, 23, 76, 85, and 86 and in new claim 92. Amended claims 1 and 19 recite, among other things:

a first regulator module ... being a self-contained assembly adapted to be installed as a unit at a first location ... and deliver a controlled DC voltage, V_f , to ... a factorized bus ... a voltage transformation module ("VTM") ... being a self-contained assembly adapted to be installed as a unit at the remote location ... to convert power from the factorized bus ... the VTM having an essentially constant voltage gain, K , an output resistance, R_{out} , and a transfer function essentially equal to $V_{out} = K(V_{in}) - R_{out}(I_{out})$;

The "separateness" of the voltage transformation in amended claims 1 and 19 is defined using the module structure, the transfer function of the module, and its *deployment at a location which is independent of the regulator assembly*. All of the independent claims include a form of this clarification. For example, added independent claim 92 defines first and second power processing stages in similar terms:

the second power processing stage receiving power processed by the first power processing stage; the first power processing stage being provided in a first self-contained module assembly adapted to be installed as an individual unit ... the second power processing stage being provided in a second self-contained module assembly adapted to be installed as an individual unit and ... using a transfer function essentially equal to $V_{out} = K(V_{in}) - R_{out}(I_{out})$ wherein K is an essentially constant voltage gain and R_{out} is an output resistance.

Amended claims 23 and 85, which use a plurality of VTMs, also specify the module structure and the transfer function. Claim 23 adds that the VTM outputs are connected in parallel while claim 85 specifies that the VTMs are at points of load. Claim 23 recites:

two or more voltage transformation modules ("VTMs") each having ... an essentially constant voltage gain K ; and (g) an output resistance, R_{out} ; wherein each VTM is a self-contained assembly adapted to be installed as a unit; wherein the outputs of the two or more VTMs are connected in parallel;

and claim 85 recites:

a plurality of **voltage transformation modules** ("VTMs") at points of load, **each VTM being a self-contained assembly adapted to be installed as an individual unit**, ... each VTM having **a transfer function essentially equal to $V_{out} = K (V_{in} - R_{out} (I_{out})$** wherein K is an essentially constant voltage gain and R_{out} is an output resistance.

In claims 22 and 76, similar "separateness" distinctions are included in addition to specifying the location of the VTMs "**at the point-of-load**" in claim 22 and "**on the load assembly**" in claim 76.

Amended claim 22 requires:

a factorized bus driven by a source of controlled DC voltage, V_f , for delivering a regulated DC voltage, V_{load} , ... a **voltage transformation module** ("VTM") having power conversion circuitry, an input terminal, and an output terminal and **being a self-contained assembly adapted to be installed as a unit at the point-of-load**; ... wherein the VTM has an essentially constant DC voltage gain, K, an output resistance, R_{out} , and **a transfer function essentially equal to $V_{out} = K (V_{in} - R_{out} (I_{out})$** .

amended claim 76 recites:

distributing power to a load assembly at a DC voltage, V_f , that is N times a voltage, V_{load} , required by load circuitry on the load assembly; providing a **voltage transformation module** ("VTM") ... being **a self contained assembly adapted to be installed as unit on the load assembly** and providing **voltage transformation** from the input to the output at an **essentially constant voltage gain, $K = 1/N$** , using a power transformer excited by a bipolar drive circuit; mounting the VTM on the load assembly and using the VTM to supply power to the load circuitry; and **providing voltage control of the DC voltage, V_f external to the VTM** to regulate V_{load} .

Amended claim 86 also recites the "separateness" of the point-of-load converter in terms of the modular structure and transfer function:

providing a first point-of-load ("POL") converter ... being **a self-contained assembly adapted to be installed as an individual unit** ... to convert power received from a bus over a normal operating input voltage range for delivery to a first load at a first load voltage; providing the first POL converter **with a transfer**

function essentially equal to $V_{out1} = K1 (V_{in}) - R_{out1} (I_{out1})$ wherein K1 is a fixed voltage gain.

Specifying in the claims that the voltage transformation is provided in a self contained VTM, POL, or second power processing stage assembly adapted to be installed as a unit and that the voltage regulation is external to the assembly clearly defines the factorized power system in terms of module structure and transfer function. The modularity specified in applicant's claims requires that the VTM be self-contained within a unit and separate from the regulation function, **providing flexibility in locating the self contained VTM in different locations independent of the location of the upstream regulator.** The "separateness" and locational flexibility of the Factorized Power Architecture resulting from the claimed modular structure and transfer function provides many benefits over the prior art (discussed at length in the February 2005 Response and in the specification). Nothing in the cited art teaches or suggests these aspects of the claims.

In contrast to applicant's claims, the Steigerwald patent does not teach anything about factorized power systems or separating the pre-regulator from the capacitance multiplying converter, let alone the benefits in power distribution efficiency or point-of-load density that might arise from deploying the CMC as *"a self-contained assembly adapted to be installed as a unit"* at locations independent of the location of the pre-regulator. In fact the Steigerwald patent teaches away from the claimed "self-contained assembly" by including in Fig. 6 a gate drive circuit 40' that is **common to both of the pre-regulator 30' and the CMC 20**, therefore teaching away from the claimed *"self-contained assembly adapted to be installed as a unit"* which is deployed *"at a remote location"* in claims 1 and 19, *"at the point-of-load"* in claim 22, *"on the load assembly"* in claim 76, *"at points of load"* in claim 85, or having "the *outputs* of the two or more VTMs *connected in parallel*" in claim 23.

The elements of the Steigerwald CMC do not satisfy claim 23 (as suggested in the rejection) for several reasons. However, it should suffice to note that claim 23 requires that each VTM be in a *"self-contained assembly."* The elements of the Steigerwald CMC do not satisfy this aspect of the claim.

Independent claims 1, 19, 22, 23, 76, 85, 86, and 92 are patentable for at least these reasons.

3. Claims 2, 17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 2, 17, and 20 except for ... a conversion efficiency greater than 80%....

4. Claims 3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 3 and 21 except for ... a series of operating cycles characterized by power transfer and energy recycling intervals...

5. Claims 4, 45, and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 4, 45, and 56 except for ... operates at or above 500 KHz....

6. Claims 6, 11, 15, 16, 24, 29, 34, 35, 42, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 6, 11, 15, 16, 24, 29, 34, 35, 42, and 43 except for controlling the bus voltage using a load voltage feedback system....

7. Claims 12-14 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a power distributing apparatus as recited by claims 12-14 and 30-32 except for ... input or output switches to protect against voltage transformation module or bus faults....

11. Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a voltage transformation module using an output current feedback signal as recited by claims 38 and 39 except for controlling the voltage transformation module using an output current feedback signal.

12. Claims 78-80 and 82-84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al teaches a voltage transformation module as recited by claims 78-80 and 82-84 except for specifying various parameters of the voltage transformation module.

Applicant respectfully disagrees that the above features are taught or suggested by the prior art and also notes that the above rejections, conclusorily stating that the above features are obvious, fail to make a prima facie case of obviousness. However, the dependent claims

discussed above are patentable for at least the same reasons as the independent claims from which they depend.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al in view of Kajouke et al (US 6,154,381).

Steigerwald et al teaches distributing apparatus as recited by claim 18 except for utilizing the power distributing apparatus in a vehicle. Kajouke et al teaches utilizing a power distributing apparatus in a vehicle was an old and known expedient in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the power of distributing apparatus of Steigerwald et al by utilizing in a vehicle order as the necessary power distributing apparatus.

Applicant respectfully disagrees. Amended independent claim 18 structurally defines the FPA's architectural separation in the same manner as in claim 1:

distributing electrical power in a vehicle comprising: using a first regulator located at a first location near a source of power in the vehicle ...deliver, at the output of the first regulator, a controlled DC voltage, V_f , to a factorized bus; using the factorized bus to distribute the controlled DC voltage, V_f , to a plurality of locations throughout the vehicle; using a plurality of **voltage transformation modules** ("VTMs") ***distributed throughout the vehicle*** to provide power to loads distributed throughout the vehicle; each VTM ... being ***a self-contained assembly adapted to be installed as a unit at a remote location*** ...having a transfer function essentially equal to $V_{out} = K(V_{in}) - R_{out}(I_{out})$; wherein each load is supplied with a respective voltage, V_{load} , essentially equal to the respective VTM output voltage, V_{out} .

Amended claim 18 additionally recites features of the FPA for use in a vehicle which further distinguishes the cited references.

Applicant agrees that electrical power distribution in automobiles is old. However, the architecture for intra vehicular electrical power distribution has been historically and continues presently to be contrary to the Factorized Power Architecture taught and claimed in the present application. A typical vehicular electrical power distribution system provides an alternator and regulator as a centralized power source for electrical systems throughout the vehicle. The Kajouke patent is just another example of the centralized power distribution system in which the voltage transformation and regulation functions **are combined in one location** in contrast to the separation required by claim 18. (The improvement in Kajouke of switching converters in and

out of the system as needed for the power demands is not relevant to the present claims.)
Nowhere does Kajouke teach or suggest the use of a VTM, let alone providing the non-disclosed VTM in “*a self-contained assembly adapted to be installed as a unit.*” It is no surprise then that Kajouke also fails to teach or suggest “using a plurality of *voltage transformation modules* (“VTMs”) *distributed throughout the vehicle.*”

Claim 18 is patentable for at least these reasons.

13. Applicant's arguments filed February 14, 2005 have been fully considered but they are not persuasive.

In response to the remarks concerning the novelty and patentability of the Factorized Power Architecture, the disclosed inventive concept of Factorized Power Architecture may very well be patentable however the claimed and recited invention does not adequately or sufficiently distinguish the inventive concept from and over the prior art as further explained below in relation to specific comments of applicants. Applicant is also reminded that the examiner is expected to give the language of pending claims the broadest reasonable interpretation.

In response to the remarks concerning the limitation of “separated by a distance”, this limitation is overly broad and generic since apparently any distance will satisfy this limitation. For example, does the limitation require that the recited elements to be separated by some miniscule distance (1 micrometer?) or required that the recited elements to be separated by some substantial distance (1 megameter?) or some reasonable distance in between? Thus what applicant apparently thinks is a definite claim limitation is in fact a claim limitation without any definitiveness.

In response to the remarks concerning the limitation of “packaged separately”, this limitation is also broad and generic since apparently any form of package separation will satisfy this limitation. For example, does the limitation require that the recited elements to be simply packaged on separate circuit boards but still within close proximity or require that the recited elements to be packaged in completely different and separate locations or something in between? Thus what applicant apparently thinks is a definite claim limitation is in fact a claim limitation without any clear definitiveness.

In response to the remarks concerning the disclosure of Steigerwald et al and the issue of “separation”, in view of the above comments about the definitiveness of the “separation” limitations Steigerwald et al does indeed broadly and generically disclose “separating” the voltage regulation (30) and the voltage transformation (20) portions of the disclosed power supply system since the two are always discussed and shown as separate circuits with separate purposes.

In response to the remarks concerning the disclosure of Steigerwald et al and the issue of “load sharing”, although the individual circuits 20 may not have a common load (and thus load sharing) each of the circuits 20 do comprise plural DC/AC/DC converters (Qa/T1/CRa and Qb/T2/CRb) that share a common load. Thus DC/AC/DC converters Qa/T1/CRa and Qb/T2/CRb could reasonably be interpreted as “load sharing” as set forth broadly and generically by the pending claims.

In summary, if applicant were to incorporate more of the disclosed inventive concept into independent claims 1-5, 19-23, 76, 81, 85, 86, and 89-91 or to at least substantially clarify and further define the currently broad/generic claim recitations of

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independent claims 1-5, 19-23, 76, 81, 85, 86, and 89-91 corresponding to the important features of the disclosed inventive concept, favorable consideration would be given to the allowance of pending claims 1-91.

Applicant thanks the Examiner for clarifying the rejection. Although applicant disagrees with the above claim interpretations, the claims have been amended, addressing the above concerns, to advance prosecution in this case.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Applicant asks that all claims be allowed.

Applicant earnestly requests the examiner to call the undersigned attorney with any questions or comments or any other matter that will help advance prosecution of this case.

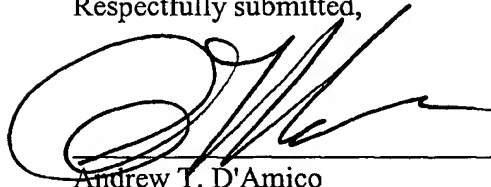
Enclosed is a check for \$120 for the required extension fee. Please apply any other charges or credits to Deposit Account No. 06 1050, referencing Attorney Docket No. 00614-136002.

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Respectfully submitted,

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